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CERTIFICATE OF ELECTRONIC FILING

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Date: April 21, 2006

Name: Gustavo Siller, Jr.

Signature: 

Our Case No. 9281-4596
Client Ref. No. N US02519

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Masamichi Saito

Serial No. 10/624,931

Filing Date: July 22, 2003

For: SPIN-VALVE MAGNETORESISTIVE
THIN FILM ELEMENT

Examiner: Brian E. Miller

Group Art Unit No. 2652

RESPONSE TO ELECTION REQUIREMENT

Commissioner for Patents
Alexandria, VA 22313-1450

Dear Sir:

This paper is submitted in response to the Election Requirement of March 21, 2006.

Listings of the Claims begins on page 2

Remarks begin on page 7.

Listings of Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Original) A spin-valve magnetoresistive thin film element, comprising:
an antiferromagnetic layer;
a pinned magnetic film contacting said antiferromagnetic layer, wherein a magnetizing direction is pinned by an exchange coupling magnetic field between said pinned magnetic layer and said antiferromagnetic layer;
a free magnetic layer; and
a nonmagnetic electrically conductive layer formed between said free magnetic layer and said pinned magnetic layer, wherein a magnetizing direction of said free magnetic layer is aligned so as to intersect with said magnetizing direction of said pinned magnetic film;
wherein said pinned magnetic film includes a first pinned magnetic layer contacting said antiferromagnetic layer and a second pinned magnetic layer and a nonmagnetic intermediate layer therebetween, wherein said first pinned magnetic layer and said second pinned magnetic layer have different thicknesses;
wherein said antiferromagnetic layer comprises one of an X-Mn alloy, where X is selected from the group consisting of Pt, Pd, Ir, Rh, Ru, Os and combinations thereof, and a Pt-Mn-X' alloy, where X' is selected from the group consisting of Pd, Ir, Rh, Ru, Os, Au, Ag and combinations thereof; and
wherein said exchange coupling magnetic field has an intensity of at least about 1 kOe.
2. (Original) A spin-valve magnetoresistive thin film element according to Claim 1, wherein said antiferromagnetic layer comprises a PtMn alloy.
3. (Original) A spin-valve magnetoresistive thin film element according to Claim 1, wherein said antiferromagnetic layer comprises a Pt-Mn-Pd alloy.

4. (Original) A spin-valve magnetoresistive thin film element according to Claim 1, wherein a ratio of said thickness of said first pinned magnetic layer and said thickness of said second pinned magnetic layer is in a range selected from the group consisting of about 0.53 to about 0.95 and about 1.05 to about 1.8.

5. (Original) A spin-valve magnetoresistive thin film element according to Claim 1, wherein a film thickness of said first pinned magnetic layer and a film thickness of said second pinned magnetic layer are both in a range of about 10 to 50 angstroms, and wherein an absolute value of film thickness of said first pinned magnetic layer minus said film thickness of said second pinned magnetic layer is at least about 2 angstroms.

6. (Original) A spin-valve magnetoresistive thin film element according to Claim 1, wherein the thickness of said nonmagnetic intermediate layer is in a range of about 4.0 to about 9.4 angstroms.

7. (Original) A spin-valve magnetoresistive thin film element according to Claim 1, wherein the thickness of said nonmagnetic intermediate layer is in a range selected from the group consisting of about 2.8 to about 6.2 angstroms and about 6.8 to about 10.2 angstroms.

8. (Original) A spin-valve magnetoresistive thin film element according to Claim 1, wherein the thickness of said antiferromagnetic layer is in a range of about 100 to 200 angstroms.

9. (Original) A thin film magnetic head, comprising shield layers formed above and below the spin-valve magnetoresistive thin film element according to Claim 1, with gap layers therebetween.

10. (Original) The spin-valve magnetoresistive thin film element according to Claim 1, wherein said nonmagnetic intermediate layer comprises at least one element selected from the group consisting of Ru, Rh, Ir, Cr, and Re.

11. (Original) The spin-valve magnetoresistive thin film element according to Claim 1, wherein said exchange coupling magnetic field has a intensity of at least about 2 kOe.

12. (Original) The spin-valve magnetoresistive thin film element according to Claim 1, wherein said exchange coupling magnetic field has an intensity of at least about 3.5 kOe.

13. (Original) A spin-valve magnetoresistive thin film element, comprising:
an antiferromagnetic layer;
a pinned magnetic film contacting said antiferromagnetic layer, wherein a magnetizing direction is pinned by an exchange coupling magnetic field between said pinned magnetic film and said antiferromagnetic layer; and
a free magnetic layer;
a nonmagnetic electrically conductive layer formed between said free magnetic layer and said pinned magnetic film, wherein a magnetizing direction of said free magnetic layer is aligned so as to intersect with the magnetizing direction of said pinned magnetic film;
wherein said pinned magnetic film includes a first pinned magnetic layer contacting said antiferromagnetic layer and a second pinned magnetic layer and a nonmagnetic intermediate layer therebetween;
wherein a product of saturation magnetization M_s and film thickness t is a magnetic film thickness, wherein said first pinned magnetic layer and said second pinned magnetic layer have different magnetic film thicknesses;
wherein said antiferromagnetic layer comprises one of an X-Mn alloy, where X is selected from the group consisting of Pt, Pd, Ir, Rh, Ru, Os and combinations thereof,

and a Pt-Mn-X' alloy, where X' is selected from the group consisting of Pd, Ir, Rh, Ru, Os, Au, Ag and combinations thereof; and

wherein said exchange coupling magnetic field has an intensity of at least about 1 kOe.

14. (Original) A spin-valve magnetoresistive thin film element according to Claim 13, wherein said antiferromagnetic layer comprises a PtMn alloy.

15. (Original) A spin-valve magnetoresistive thin film element according to Claim 13, wherein a ratio of said magnetic film thickness of said first pinned magnetic layer and said magnetic film thickness of said second pinned magnetic layer is in a range selected from the group consisting of about 0.53 to about 0.95 and about 1.05 to about 1.8.

16. (Original) A spin-valve magnetoresistive thin film element according to Claim 13, wherein said film thickness of said first pinned magnetic layer and said film thickness of said second pinned magnetic layer are both in a range of about 10 to 50 angstroms, and wherein the absolute value of said film thickness of said first pinned magnetic layer minus said film thickness of said second pinned magnetic layer is at least about 2 angstroms.

17. (Original) A spin-valve magnetoresistive thin film element according to Claim 13, wherein said thickness of said nonmagnetic intermediate layer is in a range of about 4.0 to about 9.4 angstroms.

18. (Original) A spin-valve magnetoresistive thin film element according to Claim 13, wherein said thickness of said nonmagnetic intermediate layer is in a range selected from the group consisting of about 2.8 to about 6.2 angstroms and about 6.8 to about 10.2 angstroms.

19. (Original) A spin-valve magnetoresistive thin film element according to Claim 13, wherein the thickness of said antiferromagnetic layer is in a range of about 100 to about 200 angstroms.

20. (Original) The spin-valve magnetoresistive thin film element according to Claim 13, wherein said nonmagnetic intermediate layer comprises at least one element selected from the group consisting of Ru, Rh, Ir, Cr, and Re.

21. (Original) A thin film magnetic head, comprising shield layers formed above and below the spin-valve magnetoresistive thin film element according to Claim 13, with gap layers therebetween.

22. (Original) The spin-valve magnetoresistive thin film element according to Claim 13, wherein said exchange coupling magnetic field has an intensity of at least about 2 kOe.

23. (Original) The spin-valve magnetoresistive thin film element according to Claim 13, wherein said exchange coupling magnetic field has an intensity of at least about 3.5 kOe.

24. (Original) A spin-valve magnetoresistive thin film element according to Claim 13, wherein said antiferromagnetic layer comprises a Pt-Mn-Pd alloy.

REMARKS

Restriction/Election

In response to the Election Requirement, requiring election between:

Species I: FIGs. 1 – 2,

Species II: FIGs. 3 – 4,

Species III: FIGs. 5 – 6,

Species IV: FIGs. 7 – 8,

Species V: FIGs. 9 – 10, or

Species VI: FIGs. 11 – 12,

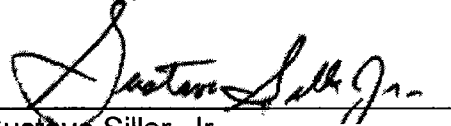
Applicants elect, Species I: drawn to a bottom type spin-valve and synthetic ferri-pinned structure, corresponding to Claims 1 -24. Applicant agrees that at least Claims 1 and 13 are generic.

Conclusion

For at least the reasons presented above, the Applicant respectfully submits that the pending claims are in condition for allowance.

The Examiner is respectfully requested to contact the undersigned in the event that a telephone interview would expedite consideration of the application.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Gustavo Siller, Jr.", written over a horizontal line.

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